Supplementary Material

Endocrine treatment near the end of life among older women with metastatic breast cancer: a nationwide cohort study

Máté Szilcz\*, Jonas W Wastesson, Amaia Calderón-Larrañaga, Lucas Morin, Henrik Lindman, Kristina Johnell

**\* Correspondence:** Máté Szilcz: mate.szilcz@ki.se

## eTable 1: Data sources

| **Register** | **Register holder** | **Start** | **Completeness** | **Geographical coverage** | **Content** | **Externally validated** |
| --- | --- | --- | --- | --- | --- | --- |
| Total Population Register(1) | Statistics Sweden | 1968 | The over-coverage has been estimated to 0.1 % for Nordic citizens but substantially higher for individuals born outside the Nordic countries (potentially 4–8 %) | Nationwide  | Sex, date of birth, country of birth, municipality of residence, living arrangement, civil status, year of first and last immigration, year of last emigration | Yes |
| National Cause Of Death Register(2) | National Board of Health and Welfare | Complete since 1952 | 99% of all deaths are documented with an underlying cause of death | Nationwide | Sex, date of birth, underlying and contributing causes of death (ICD-10), place of death, civil status | Yes |
| National Patient Register(3) | National Board of Health and Welfare | Inpatient care coverage complete since 1987Specialised outpatient care since 2001 | 99% of all somatic and psychiatric hospital discharges are registered.Outpatient diagnoses coverage lower than inpatient data but above 80% | Nationwide | Sex, age, date of admission and discharge, planned/unplanned admission, main diagnosis, secondary diagnoses, injuries, medical or surgical procedures, department of admission, provenance, destination. | The inpatient register part has an overall positive predictive value of diagnosis of 85%-95% |
| Swedish Prescribed Drug Register(4, 5) | National Board of Health and Welfare | July 2005 | 85% of all sold defined daily doses (DDDs) are covered by the registerThe remaining 15% are Over-the-counter medications (12% of DDDs), drugs administered in hospitals (3% of DDDs)  | Nationwide | Sex, age, date of prescription, date of dispensing, type of dispensing (e.g. multi-dose), total dose, prescribed daily dose (free text), number of DDDs dispensed, ATC code, generic name, costs, characteristics of prescribers | Yes |
| Swedish Register of Education(6) |  | 1985 (annual updates from 2000), earlier versions have been produced in the 1930 and 1970 census | Population aged 16-74 years old registered as resident in Sweden at 1 January each year. From 2007, information for the group 75+ is also collected | Nationwide | Highest educational attainment | Yes |

## eFigure 1: Illustration of the study design



## eTable 2: Details of diagnosis codes used to identify potentially unexpected causes of death in older adults

|  |  |  |
| --- | --- | --- |
| **ICD Chapter** | **Main criteria** | **Conditional arguments** |
| *Source(s) of data:* | *National cause of death register (underlying causes of death)* | *National patient register (all inpatient and specialized outpatient care diagnosesa)* |
| Certain infectious and parasitic diseases | A00; A01; A02; A03; A04; A05; A06; A07; A08; A09; A39; A40; A41; A499; A80; A81; A87; B371; B375; B377; B440; B441; B448; B449; B99 |  |
| Diseases of the blood and blood-forming organs | D611; D619; D649 |  |
| Endocrine, nutritional and metabolic diseases | E86 |  |
| Diseases of the nervous system | G000; G001; G002; G003; G009; G039; G040; G048; G049; G060; G062; G931; G936 |  |
| Ischaemic heart diseases and pulmonary heart diseases | I21; I23; I25; I249; I249; I255; I26; I28 | No history of ischemic heart disease (I20-I25) or pulmonary embolism (I26) |
| Other forms of heart disease | I30; I33; I40; I461; I469 |  |
| Cerebrovascular diseases | I60; I61; I62; I63; I64; I65; I66; I67 | No history of cerebrovascular disease (I60-I69) |
| Diseases of arteries, arterioles and capillaries | I71; I72; I74; I97 |  |
|  Diseases of the respiratory system | J069; J09; J10; J11; J12; J13; J14; J15; J18; J22; J690; J81; J851; J852; J93; J958; J960 |  |
|  Diseases of the digestive system | K250; K251; K252; K253; K254; K255; K256; K257; K259; K260; K261; K263; K264; K265; K266; K269; K550; K65; K720; K810; K859 |  |
|  Diseases of the musculoskeletal system and connective tissue | M726 |  |
|  Diseases of the genitourinary system | N00; N04; N10; N17; N390; N990; N998 | No history of diabetes (E10-14) or renal failure (N18-19) |
|  Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified | R02; R572; R570; R571 |  |
|  Injury, poisoning and certain other consequences of external causes | S065; S066; S068; S069; S071; S10-99; T00-T99 |  |
|  External causes of morbidity and mortality | V00-V99; X60-79; X80-84 |  |

Abbreviations: ICD-10: International Classification of Diseases, 10th revision;

*a: Diagnoses codes were captured in the National Patient Register during the period ranging from 5 year before death until death.*

Source: eTable 3 of Morin et al 2019 (7)

## eFigure 2: Treatment patterns at the end of life



Adapted from Morin et al. 2019 (8). Treatment continuation was defined as endocrine treatment dispensing during the last three months of life given previous use during the prior nine months (i.e., between 365-91 days before death). Treatment initiation was defined as the dispensing of endocrine treatment during the last three months of life, given no endocrine treatment during the prior nine months. Treatment discontinuation was defined when the end date of the treatment exposure window extended into the last three months of life. No use was defined as no dispensation or discontinuation earlier than the last three months of life.

## eTable 3: Details of diagnosis codes and drugs used to detect chronic conditions

| **Chronic disease** | **ICD-10 Codes** | **ATC Codes** |
| --- | --- | --- |
| Source(s) of data: | National Patient Register (all inpatient and specialized outpatient diagnoses) | National Prescribed Drugs Register |
| 1. Allergy
 | J30.1-J30.4; J45.0; K52.2; L20; L23; L50.0; Z51.6 |  |
| 1. Anaemia
 | D50-D53; D55-D59 (excl. D56.3; D59.0; D59.2; D59.3; D59.6); D60-D64 (excl. D60.1; D61.1; D61.2; D62; D64.2) | B03A, B03XA |
| 1. Asthma
 | J45 | R03DC; R03BC |
| 1. Atrial fibrillation
 | I48 |  |
| 1. Autoimmune diseases
 | I73.1; L10 (excl. L10.5); L12; L40; L41; L93-L95; M30-M36 (excl. M32.0; M34.2; M35.7-M35.9; M36.0; M36.1; M36.2; M36.3) | D05 |
| 1. Blindness, visual loss
 | H54 (excl. H54.3); Z44.2; Z97.0 |  |
| 1. Blood and blood forming organ diseases
 | D66-D69 (excl. D68.3; D68.4; D69.5); D71; D72.0; D73.0-D73.2; D74 (excl. D74.8); D75.0; D76.1; D76.3; D77; D80 (excl. D80.7); D81-D84; D86; D89 (excl. D89.1; D89.3)  |  |
| 1. Bradycardias and conduction diseases
 | I44.1-I44.3; I45.3; I45.5; Z95.0 |  |
| 1. Cardiac valve diseases
 | I05-I08; I09.1; I09.8; I34-I38; I39.0-I39.4; Q22; Q23; Z95.2-Z95.4 |  |
| 1. Cataract and other lens diseases
 | H25-H28; Q12; Z96.1 |  |
| 1. Cerebrovascular disease
 | G45; G46; I60-I64; I67; I69 |  |
| 1. Chromosomal abnormalities
 | Q90-Q99 |  |
| 1. Chronic infectious diseases
 | A15-A19; A30; A31; A50-A53 (excl. A51); A65-A67; A69.2; A81; B20-B24; B38.1; B39.1; B40.1; B57.2-B57.5; B65; B92; B94; J65; M86.3-M86.6  | J04A, excl. J04AB01, J04AB02, J04AB03 and J04AC |
| 1. Chronic kidney disease
 | I12.0; I13.0-I13.9; N01, N02, N04, N05; N07; N08; N11; N18.3-N18.9; Q60; Q61.1-Q61.9; Z90.5; Z94.0 |  |
| 1. Chronic liver disease
 | B18; K70 (excl. K70.0; K70.1); K71.3-K71.5; K71.7; K72.1; K73; K74; K75.3-K75.8; K76.1; K76.6; K76.7; K77.8; Q44.6; Z94.4 |  |
| 1. Chronic pancreas, biliary tract and gallbladder diseases
 | K80.0; K80.1; K80.2; K80.8; K81.1; K86 (excl. K86.2; K86.3; K86.9); Q44.0-Q44.5; Q45.0 | A09AA02 |
| 1. Chronic ulcer of the skin
 | I83.0; I83.2; L89; L97; L98.4 |  |
| 1. Colitis and related diseases
 | K52.0; K52.8; K55.1; K55.2; K57.2-K57.5; K57.8; K57.9; K58; K59.0; K59.2; K62 (excl. K62.0; K62.1; K62.5; K62.6); K63.4; K64 (excl. K64.5);  |  |
| 1. COPD, emphysema, chronic bronchitis
 | J41-J44; J47 | R03BB |
| 1. Deafness, hearing loss
 | H80; H90; H91.1; H91.3; H91.9; Q16; Z45.3; Z46.1; Z96.2; Z97.4 |  |
| 1. Dementia
 | F00-F03; F05.1; G30; G31 | N06DA, N06DX01 |
| 1. Depression and mood diseases
 | F30-F34; F38; F39; F41.2 |  |
| 1. Diabetes
 | E10; E11; E13; E14; E89.1 | A10 |
| 1. Dorsopathies
 | M40-M43; M47-M53; Q67.5; Q76.4; Q76.1;  |  |
| 1. Dyslipidemia
 | E78 |  |
| 1. Ear, nose, throat diseases
 | H60.4; H66.1-H66.3; H70.1; H71; H73.1; H74.1; H81.0; H83.1; H83.2; H95; J30.0; J31-J33; J34.1-J34.3; J35; J37; J38.0; J38.6; K05.1; K05.3; K07; K11.0; K11.7; Q30-Q32; Q35-Q38 |  |
| 1. Epilepsy
 | G40 (excl. G40.5) |  |
| 1. Esophagus, stomach and duodenum diseases
 | I85; I86.4; I98.2; I98.3; K21; K22.0; K22.2; K22.4; K22.5; K22.7; K23.0; K23.1; K25.4-K25.7; K26.4-K26.7; K27.4-K27.7; K28.4-K28.7; K29.3-K29.9; K31.1-K31.5; Q39; Q40; Z90.3 | A02BX |
| 1. Glaucoma
 | H40.1-H40.9 | S01ED |
| 1. Heart failure
 | I11.0; I13.0; I13.2; I27; I28.0; I42; I43; I50; I51.5; I51.7; I52.8; Z94.1; Z94.3 |  |
| 1. Hematological neoplasms
 | C81-C96 |  |
| 1. Hypertension
 | I10-I15 |  |
| 1. Inflammatory arthropathies
 | M02.3; M05-M14; M45; M46.0; M46.1; M46.8; M46.9 | M01CB |
| 1. Inflammatory bowel disease
 | K50; K51 | A07E |
| 1. Ischemic heart disease
 | I20-I22; I24; I25; Z95.1; Z95.5 | C01DA, C01EB18 |
| 1. Migraine and facial pain syndromes
 | G43; G44.0-G44.3; G44.8; G50 | N02C |
| 1. Multiple sclerosis
 | G35 |  |
| 1. Neurotic, stress-related and somatoform diseases
 | F40-F48 (excl. F43.0; F43.2) |  |
| 1. Obesity
 | E66 |  |
| 1. Osteoarthritis and other degenerative joint diseases
 | M15-M19; M36.2; M36.3 |  |
| 1. Osteoporosis
 | M80-M82 | M05BA; M05BB; M05BX03; M05BX53 |
| 1. Other cardiovascular diseases
 | I09 (excl. I09.1; I09.8); I28.1; I31.0; I31.1; I45.6; I49.5; I49.8; I70-I72 (excl. I70.2); I79.0; I79.1; I95.0; I95.1; I95.8; Q20; Q21; Q24-Q28; Z95.8; Z95.9 |  |
| 1. Other digestive diseases
 | K66.0; K90.0-K90.2; K91.1; K93; Q41-Q43; R15; Z90.4; Z98.0 |  |
| 1. Other eye diseases
 | H02.2-H02.5; H04 (excl. H04.3); H05 (excl. H05.0); H10.4; H17; H18.4-H18.9; H19.3; H19.8; H20.1; H21; H31.0-H31.2; H31.8; H31.9; H33; H35.2-H35.5; H35.7-H35.9; H36; H47-H49 (excl. H47.0; H47.1; H48.1); H51; Q10-Q15 (excl. Q12); Z94.7 |  |
| 1. Other genitourinary diseases
 | B90.1; N20.0; N20.2; N20.9; N21.0; N21.8; N21.9; N22; N30.1-N30.4; N31; N32.0; N32.3; N32.8; N32.9; N33; N35; N39.3; N39.4; N48.0; N48.4; N48.9; N70.1; N71.1; N73.1; N73.4; N73.6; N76.1; N76.3; N81; N88; N89.5; N90.5; N95.2; Q54; Q62.0-Q62.4; Q62.7; Q62.8; Q63.8; Q63.9; Q64.0; Q64.1; Q64.3-Q64.9; Z90.6; Z90.7; Z96.0 |  |
| 1. Other metabolic diseases
 | E20-E31 (excl. E23.1; E24.2; E24.4; E27.3; E30); E34 (excl. E34.3; E34.4); E35 (excl. E35.0); E40-E46 (excl. E44.1); E64; E70-E72; E74-E77; E79 (excl. E79.0); E80 (excl. E80.4); E83-E89 (excl. E86; E87; E88.3; E89.0; E89.1); K90.3; K90.4; K90.8; K90.9; K91.2; M83; M88; N25  |  |
| 1. Other musculoskeletal and joint diseases
 | B90.2; M21.2-M21.9; M22-M24; M25.2; M25.3; M35.7; M61; M65.2-M65.4; M70.0; M72.0; M72.2; M72.4; M75.0; M75.1; M75.3; M75.4; M79.7; M84.1; M89; M91; M93; M94; M96; M99; S38.2; S48; S58; S68; S78; S88; S98; T05; T09.6; T11.6; T13.6; T14.7; T90-T98; Q65; Q66; Q68; Q71-Q74; Q77; Q78; Q79.6; Q79.8; Q87; Z44.0; Z44.1; Z89.1-Z89.9; Z94.6; Z96.6; Z97.1 |  |
| 1. Other neurological diseases
 | B90.0; D48.2; G04.1; G09-G14 (excl. G13.0; G13.1); G24-G26 (excl. G25.1; G25.4; G25.6); G32; G37; G51-G53 (excl. G51.0); G70; G71; G72.3-72.9; G73 (excl. G73.2-G73.4); G80-G83 (excl. G83.8); G90; G91; G93.8; G93.9; G95; G99; M47.1; Q00-Q07; Q76.0 |  |
| 1. Other psychiatric and behavioral diseases
 | F04; F06; F07; F09; F10.2; F10.6; F10.7; F11.2; F11.6; F11.7; F12.2; F12.6; F12.7; F13.2; F13.6; F13.7; F14.2; F14.6; F14.7; F15.2; F15.6; F15.7; F16.2; F16.6; F16.7; F17.2; F17.6; F17.7; F18.2; F18.6; F18.7; F19.2; F19.6; F19.7; F50; F52; F60-F63; F68; F70-F89; F95; F99 | N07BB |
| 1. Other respiratory diseases
 | B90.9; E66.2; J60-J67; J68.4; J70.1; J70.3; J70.4; J84; J92; J94.1; J95.3; J95.5; J96.1; J98 (excl. J98.1); Q33; Q34; Z90.2; Z94.2; Z94.3; Z96.3 |  |
| 1. Other skin diseases
 | L13; L28; L30.1; L43 (excl. L43.2); L50.8; L58.1; L85; Q80; Q81; Q82.1; Q82.2; Q82.9 |  |
| 1. Parkinson and parkinsonism
 | G20-G23 (excl. G21.0)  | N04BA; N04BX  |
| 1. Peripheral neuropathy
 | B91; G54-G60; G62.8; G62.9; G63 (excl. G63.1); M47.2; M53.1; M54.1 |  |
| 1. Peripheral vascular disease
 | I70.2; I73 (excl. I73.1; I73.8); I79.2; I79.8 | B01AC23 |
| 1. Prostate diseases
 | N40; N41.1; N41.8 | G04C (excl. G04CB) |
| 1. Schizophrenia and delusional diseases
 | F20; F22; F24; F25; F28 |  |
| 1. Sleep disorders
 | G47; F51.0-F51.3 |  |
| 1. Solid neoplasms\*
 | All C (excl.C50, C78, C79, C81-C96); D00-D09; D32.0; D32.1; D32.9; D33.0-D33.4; Q85  |  |
| 1. Thyroid disease
 | E00-E03 (excl. E03.5); E05; E06.2; E06.3; E06.5; E07; E35.0; E89.0 | H03AA; H03B |
| 1. Venous and lymphatic diseases
 | I78.0; I83; I87; I89; I97.2; Q82.0  |  |

Abbreviations: ICD-10: International Classification of Diseases, 10th revision; ATC: Anatomical Therapeutic Chemical classification system

\*Codes used to identify breast cancer (C50, and metastasis C78, C79) were excluded

## eTable 4: Diagnosis codes and weights used to calculate the Hospital Frailty Risk score

|  |  |  |
| --- | --- | --- |
| **Conditions** | **ICD10-codes\*** | **Weight** |
| Dementia in Alzheimer's disease  | F00 | 7.1 |
| Hemiplegia  | G81 | 4.4 |
| Alzheimer's disease  | G30 | 4 |
| Sequelae of cerebrovascular disease (secondary codes)  | I69 | 3.7 |
| Other symptoms and signs involving the nervous and musculoskeletal systems (R29·6 Tendency to fall)  | R29 | 3.6 |
| Other disorders of urinary system (includes urinary tract infection and urinary incontinence)  | N39 | 3.2 |
| Delirium, not induced by alcohol and other psychoactive substances  | F05 | 3.2 |
| Unspecified fall  | W19 | 3.2 |
| Superficial injury of head  | S00 | 3.2 |
| Unspecified haematuria  | R31 | 3 |
| Other bacterial agents as the cause of diseases classified to other chapters (secondary code)  | B96 | 2.9 |
| Other symptoms and signs involving cognitive functions and awareness  | R41 | 2.7 |
| Abnormalities of gait and mobility  | R26 | 2.6 |
| Other cerebrovascular diseases  | I67 | 2.6 |
| Convulsions, not elsewhere classified  | R56 | 2.6 |
| Somnolence, stupor and coma  | R40 | 2.5 |
| Complications of genitourinary prosthetic devices, implants and grafts  | T83 | 2.4 |
| Intracranial injury  | S06 | 2.4 |
| Fracture of shoulder and upper arm  | S42 | 2.3 |
| Other disorders of fluid, electrolyte and acid-base balance  | E87 | 2.3 |
| Other joint disorders, not elsewhere classified  | M25 | 2.3 |
| Volume depletion  | E86 | 2.3 |
| Senility  | R54 | 2.2 |
| Care involving use of rehabilitation procedures  | Z50 | 2.1 |
| Unspecified dementia  | F03 | 2.1 |
| Other fall on same level  | W18 | 2.1 |
| Problems related to medical facilities and other health care  | Z75 | 2 |
| Vascular dementia  | F01 | 2 |
| Superficial injury of lower leg  | S80 | 2 |
| Cellulitis  | L03 | 2 |
| Blindness and low vision  | H54 | 1.9 |
| Deficiency of other B group vitamins  | E53 | 1.9 |
| Problems related to social environment  | Z60 | 1.8 |
| Parkinson's disease  | G20 | 1.8 |
| Syncope and collapse  | R55 | 1.8 |
| Fracture of rib(s), sternum and thoracic spine  | S22 | 1.8 |
| Other functional intestinal disorders  | K59 | 1.8 |
| Acute renal failure  | N17 | 1.8 |
| Decubitus ulcer  | L89 | 1.7 |
| Carrier of infectious disease  | Z22 | 1.7 |
| Streptococcus and staphylococcus as the cause of diseases classified to other chapters  | B95 | 1.7 |
| Ulcer of lower limb, not elsewhere classified  | L97 | 1.6 |
| Other symptoms and signs involving general sensations and perceptions  | R44 | 1.6 |
| Duodenal ulcer  | K26 | 1.6 |
| Hypotension  | I95 | 1.6 |
| Unspecified renal failure  | N19 | 1.6 |
| Other septicaemia  | A41 | 1.6 |
| Personal history of other diseases and conditions  | Z87 | 1.5 |
| Respiratory failure, not elsewhere classified  | J96 | 1.5 |
| Exposure to unspecified factor  | X59 | 1.5 |
| Other arthrosis  | M19 | 1.5 |
| Epilepsy  | G40 | 1.5 |
| Osteoporosis without pathological fracture  | M81 | 1.4 |
| Fracture of femur  | S72 | 1.4 |
| Fracture of lumbar spine and pelvis  | S32 | 1.4 |
| Other disorders of pancreatic internal secretion  | E16 | 1.4 |
| Abnormal results of function studies  | R94 | 1.4 |
| Chronic renal failure  | N18 | 1.4 |
| Retention of urine  | R33 | 1.3 |
| Unknown and unspecified causes of morbidity  | R69 | 1.3 |
| Other disorders of kidney and ureter, not elsewhere classified  | N28 | 1.3 |
| Unspecified urinary incontinence  | R32 | 1.2 |
| Other degenerative diseases of nervous system, not elsewhere classified  | G31 | 1.2 |
| Nosocomial condition  | Y95 | 1.2 |
| Other and unspecified injuries of head  | S09 | 1.2 |
| Symptoms and signs involving emotional state  | R45 | 1.2 |
| Transient cerebral ischaemic attacks and related syndromes  | G45 | 1.2 |
| Problems related to care-provider dependency  | Z74 | 1.1 |
| Other soft tissue disorders, not elsewhere classified  | M79 | 1.1 |
| Fall involving bed  | W06 | 1.1 |
| Open wound of head  | S01 | 1.1 |
| Other bacterial intestinal infections  | A04 | 1.1 |
| Diarrhoea and gastroenteritis of presumed infectious origin  | A09 | 1.1 |
| Pneumonia, organism unspecified  | J18 | 1.1 |
| Pneumonitis due to solids and liquids  | J69 | 1 |
| Speech disturbances, not elsewhere classified  | R47 | 1 |
| Vitamin D deficiency  | E55 | 1 |
| Artificial opening status  | Z93 | 1 |
| Gangrene, not elsewhere classified  | R02 | 1 |
| Symptoms and signs concerning food and fluid intake  | R63 | 0.9 |
| Other hearing loss  | H91 | 0.9 |
| Fall on and from stairs and steps  | W10 | 0.9 |
| Fall on same level from slipping, tripping and stumbling  | W01 | 0.9 |
| Thyrotoxicosis [hyperthyroidism]  | E05 | 0.9 |
| Scoliosis  | M41 | 0.9 |
| Dysphagia  | R13 | 0.8 |
| Dependence on enabling machines and devices  | Z99 | 0.8 |
| Agent resistant to penicillin and related antibiotics  | U80 | 0.8 |
| Osteoporosis with pathological fracture  | M80 | 0.8 |
| Other diseases of digestive system  | K92 | 0.8 |
| Cerebral Infarction  | I63 | 0.8 |
| Calculus of kidney and ureter  | N20 | 0.7 |
| Mental and behavioural disorders due to use of alcohol  | F10 | 0.7 |
| Other medical procedures as the cause of abnormal reaction | Y84 | 0.7 |
| Abnormalities of heart beat  | R00 | 0.7 |
| Unspecified acute lower respiratory infection  | J22 | 0.7 |
| Problems related to life-management difficulty  | Z73 | 0.6 |
| Other abnormal findings of blood chemistry  | R79 | 0.6 |
| Personal history of risk-factors, not elsewhere classified  | Z91 | 0.5 |
| Open wound of forearm  | S51 | 0.5 |
| Depressive episode  | F32 | 0.5 |
| Spinal stenosis (secondary code only)  | M48 | 0.5 |
| Disorders of mineral metabolism  | E83 | 0.4 |
| Polyarthrosis  | M15 | 0.4 |
| Other anaemias  | D64 | 0.4 |
| Other local infections of skin and subcutaneous tissue  | L08 | 0.4 |
| Nausea and vomiting  | R11 | 0.3 |
| Other noninfective gastroenteritis and colitis  | K52 | 0.3 |
| Fever of unknown origin  | R50 | 0.1 |

Abbreviations: ICD-10: International Classification of Diseases, 10th revision;

\*Identified from the National Patient Register

## eTable 5: RECORD statement

|  |  |  |
| --- | --- | --- |
| **Item No** | **Recommendation** | **Section** |
|  **Title and abstract** | 1 | (1)The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included. | Abstract |
| (2) If applicable, the geographic region and timeframe within which the study took place should be reported in the title or abstract. | Abstract |
| (3) If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract. | Abstract |
| **Introduction** |  |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | Introduction |
| Objectives | 3 | State specific objectives, including any prespecified hypotheses | Introduction - last paragraph |
| **Methods** |  |
| Study design | 4 | Present key elements of study design early in the paper | Methods – Study design and population section |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | Methods – Study design and population section |
| Participants | 6 | (*1*) The methods of study population selection (such as codes or algorithms used to identify subjects) should be listed in detail. If this is not possible, an explanation should be provided.  | Methods – Study design and population section |
| (*2*)Any validation studies of the codes or algorithms used to select the population should be referenced. If validation was conducted for this study and not published elsewhere, detailed methods and results should be provided. | NA |
|  |  | (3) If the study involved linkage of databases, consider use of a flow diagram or other graphical display to demonstrate the data linkage process, including the number of individuals with linked data at each stage. | Figure 1eFigure 1 |
| Variables | 7 | A complete list of codes and algorithms used to classify exposures, outcomes, confounders, and effect modifiers should be provided. If these cannot be reported, an explanation should be provided. | Methods – Patient-level characteristicseTable 2eTable 3eTable 4 |
| Data sources/ measurement | 8\* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | eTable 1 |
| Bias | 9 | Describe any efforts to address potential sources of bias | Discussion – strength and limitations |
| Study size | 10 | Explain how the study size was arrived at | Figure 1 |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | Methods – Outcome, Patient-level characteristics |
| Statistical methods | 12 | (*a*) Describe all statistical methods, including those used to control for confounding | Methods – Statistical analysis |
| (*b*) Describe any methods used to examine subgroups and interactions | Methods – Statistical analysis |
| (*c*) Explain how missing data were addressed | NA |
| (*d*) If applicable, explain how loss to follow-up was addressed | NA |
| (*e*) Describe any sensitivity analyses | Methods – Statistical analysis |
| Data access and cleaning methods |  | Authors should describe the extent to which the investigators had access to the database population used to create the study population. | Methods – Study design and population |
| Authors should provide information on the data cleaning methods used in the study. | NA |
| State whether the study included person-level, institutional-level, or other data linkage across two or more databases. The methods of linkage and methods of linkage quality evaluation should be provided. | Methods – Data sources |
| **Results** |  |
| Participants | 13\* | (a) Describe in detail the selection of the persons included in the study (i.e., study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram. | Results - characteristics of the study population |
| (b) Give reasons for non-participation at each stage | Results - characteristics of the study population |
| (c) Consider use of a flow diagram | Figure 1 |
| Descriptive data | 14\* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders | Results - characteristics of the study population |
| (b) Indicate number of participants with missing data for each variable of interest | Table 1 |
| (c) Summarise follow-up time (eg, average and total amount) | NA |
| Outcome data | 15\* | Report numbers of outcome events or summary measures over time | Table 2 |
| Main results | 16 | (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | Table 3 |
| (*b*) Report category boundaries when continuous variables were categorized | Table 1 |
| (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | NA |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | Results – Sensitivity analysiseTable 6eTable 7 |
| **Discussion** |  |
| Key results | 18 | Summarise key results with reference to study objectives | Discussion – first paragraph |
| Limitations | 19 | Discuss the implications of using data that were not created or collected to answer the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over time, as they pertain to the study being reported. | Discussion – last paragraph of Interpretation and implications section |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | Discussion first paragraphs |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | Discussion – strength and limitations |
| **Other information** |  |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | Acknowledgements: Funding |
| Accessibility of protocol, raw data, and programming code |  | Authors should provide information on how to access any supplemental information such as the study protocol, raw data, or programming code. | Acknowledgements: Availability of data and materials |

Source: RECORD guidelines(9)

## eTable 6: Endocrine treatment patterns at the end of life of women who died with hormone receptor-positive metastatic breast cancer, aged ≥65 years in Sweden, 2016-2020, stratified by patient characteristics

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Overall****N(% total)** | **Continuation****N(% total)** | **Discontinuation****N(% total)** | **Initiation****N(% total)** | **No use****N(% total)** |
| **Total** | 3098 (100%) | 1217 (100%) | 968 (100%) | 157 (100%) | 756 (100%) |
| **Age at time of death, years** |  |  |  |  |  |  |
| 65 to 74 years | 1176 (38.0%) | 315 (25.9%) | 401 (41.4%) | 83 (52.9%) | 377 (49.9%) |
| 75 to 84 years | 1140 (36.8%) | 459 (37.7%) | 358 (37.0%) | 50 (31.8%) | 273 (36.1%) |
| 85 years and older | 782 (25.2%) | 443 (36.4%) | 209 (21.6%) | 24 (15.3%) | 106 (14.0%) |
| **Education, No. (%)** |  |  |  |  |  |  |
| Primary education | 1089 (35.2%) | 511 (42.0%) | 294 (30.4%) | 56 (35.7%) | 228 (30.2%) |
| Secondary education | 1154 (37.2%) | 421 (34.6%) | 386 (39.9%) | 55 (35.0%) | 292 (38.6%) |
| Tertiary education | 812 (26.2%) | 260 (21.4%) | 274 (28.3%) | 45 (28.7%) | 233 (30.8%) |
| Missing | 43 (1.4%) | 25 (2.1%) | 14 (1.4%) | 1 (0.6%) | 3 (0.4%) |
| **Marital status** |  |  |  |  |  |  |
| Married | 1178 (38.0%) | 374 (30.7%) | 393 (40.6%) | 68 (43.3%) | 343 (45.4%) |
| Single/divorced | 878 (28.3%) | 317 (26.0%) | 292 (30.2%) | 50 (31.8%) | 219 (29.0%) |
| Widowed | 1042 (33.6%) | 526 (43.2%) | 283 (29.2%) | 39 (24.8%) | 194 (25.7%) |
| **Living arrangement** |  |  |  |  |  |
| Community-dwelling | 2747 (88.7%) | 981 (80.6%) | 905 (93.5%) | 152 (96.8%) | 709 (93.8%) |
| Nursing home | 351 (11.3%) | 236 (19.4%) | 63 (6.5%) | 5 (3.2%) | 47 (6.2%) |
| **Income quintiles** |  |  |  |  |  |
| Fifth | 733 (23.7%) | 256 (21.0%) | 232 (24.0%) | 36 (22.9%) | 209 (27.6%) |
| Fourth | 636 (20.5%) | 245 (20.1%) | 217 (22.4%) | 29 (18.5%) | 145 (19.2%) |
| Third | 509 (16.4%) | 234 (19.2%) | 152 (15.7%) | 17 (10.8%) | 106 (14.0%) |
| Second | 568 (18.3%) | 229 (18.8%) | 175 (18.1%) | 38 (24.2%) | 126 (16.7%) |
| First | 652 (21.0%) | 253 (20.8%) | 192 (19.8%) | 37 (23.6%) | 170 (22.5%) |
| **Frailty** |  |  |  |  |  |  |
| Low | 2050 (66.2%) | 761 (62.5%) | 657 (67.9%) | 114 (72.6%) | 518 (68.5%) |
| Moderate | 684 (22.1%) | 269 (22.1%) | 223 (23.0%) | 33 (21.0%) | 159 (21.0%) |
| High | 364 (11.7%) | 187 (15.4%) | 88 (9.1%) | 10 (6.4%) | 79 (10.4%) |
| **Number of chronic diseases** |  |  |  |  |  |  |
| 0-1 | 305 (9.8%) | 102 (8.4%) | 97 (10.0%) | 22 (14.0%) | 84 (11.1%) |
| 2-3 | 748 (24.1%) | 286 (23.5%) | 227 (23.5%) | 42 (26.8%) | 193 (25.5%) |
| 4-5 | 845 (27.3%) | 307 (25.2%) | 270 (27.9%) | 44 (28.0%) | 224 (29.6%) |
| >=6 | 1200 (38.7%) | 522 (42.9%) | 374 (38.6%) | 49 (31.2%) | 255 (33.7%) |
| **Years since metastasis** |  |  |  |  |  |
| <1 year | 1073 (34.6%) | 542 (44.5%) | 359 (37.1%) | 52 (33.1%) | 120 (15.9%) |
| 1-3 years | 1021 (33.0%) | 368 (30.2%) | 326 (33.7%) | 55 (35.0%) | 272 (36.0%) |
| >3 years | 1004 (32.4%) | 307 (25.2%) | 283 (29.2%) | 50 (31.8%) | 364 (48.1%) |
| **Multi-dose dispensing** |  |  |  |  |  |  |
| No | 2232 (72.0%) | 720 (59.2%) | 750 (77.5%) | 132 (84.1%) | 630 (83.3%) |
| Yes | 866 (28.0%) | 497 (40.8%) | 218 (22.5%) | 25 (15.9%) | 126 (16.7%) |
| **Years on endocrine treatment** |  |  |  |  |  |
| <1 | 787 (25.4%) | 297 (24.4%) | 227 (23.5%) | 65 (41.4%) | 198 (26.2%) |
| 1-2 | 840 (27.1%) | 304 (25.0%) | 244 (25.2%) | 40 (25.5%) | 252 (33.3%) |
| >3 | 1471 (47.5%) | 616 (50.6%) | 497 (51.3%) | 52 (33.1%) | 306 (40.5%) |
| **Inpatient days in the last 3 months of life** |  |  |  |  |  |
|  No hospitalisation | 757 (24.4%) | 370 (30.4%) | 202 (20.9%) | 20 (12.7%) | 165 (21.8%) |
| 1-14 | 1077 (34.8%) | 406 (33.4%) | 347 (35.8%) | 66 (42.0%) | 258 (34.1%) |
| 15-30 | 785 (25.3%) | 296 (24.3%) | 246 (25.4%) | 47 (29.9%) | 196 (25.9%) |
| >30 | 479 (15.5%) | 145 (11.9%) | 173 (17.9%) | 24 (15.3%) | 137 (18.1%) |
| **CDK4/6 use** |  |  |  |  |  |
| No | 2979 (96.2%) | 1158 (95.2%) | 940 (97.1%) | 140 (89.2%) | 741 (98.0%) |
| Yes | 119 (3.8%) | 59 (4.8%) | 28 (2.9%) | 17 (10.8%) | 15 (2.0%) |
| **Hospital chemotherapy use** |  |  |  |  |  |
| No | 2936 (94.8%) | 1188 (97.6%) | 902 (93.2%) | 147 (93.6%) | 699 (92.5%) |
| Yes | 162 (5.2%) | 29 (2.4%) | 66 (6.8%) | 10 (6.4%) | 57 (7.5%) |
| **Cortisone use** |  |  |  |  |  |
| No | 1847 (59.6%) | 796 (65.4%) | 556 (57.4%) | 73 (46.5%) | 422 (55.8%) |
| Yes | 1251 (40.4%) | 421 (34.6%) | 412 (42.6%) | 84 (53.5%) | 334 (44.2%) |
| **Death Year** |  |  |  |  |  |
| 2016 | 593 (19.1%) | 222 (18.2%) | 190 (19.6%) | 33 (21.0%) | 148 (19.6%) |
| 2017 | 623 (20.1%) | 243 (20.0%) | 191 (19.7%) | 36 (22.9%) | 153 (20.2%) |
| 2018 | 618 (19.9%) | 251 (20.6%) | 204 (21.1%) | 33 (21.0%) | 130 (17.2%) |
| 2019 | 602 (19.4%) | 251 (20.6%) | 181 (18.7%) | 33 (21.0%) | 137 (18.1%) |
| 2020 | 662 (21.4%) | 250 (20.5%) | 202 (20.9%) | 22 (14.0%) | 188 (24.9%) |
|  |  |  |  |  |  |

## eTable 7: Distribution of chronic comorbidities

|  |  |  |  |
| --- | --- | --- | --- |
| **Chronic comorbidities\*** | **Overall(N=3098)** | **Prevalent use(N=2185)** | **Non-users(N=913)** |
| Allergy | 31 (1.0%) | 16 (0.7%) | 15 (1.6%) |
| Anemia | 529 (17.1%) | 361 (16.5%) | 168 (18.4%) |
| Asthma | 157 (5.1%) | 114 (5.2%) | 43 (4.7%) |
| Atrial fibrillation | 479 (15.5%) | 386 (17.7%) | 93 (10.2%) |
| Autoimmune diseases | 177 (5.7%) | 123 (5.6%) | 54 (5.9%) |
| Blindness, visual loss | 35 (1.1%) | 20 (0.9%) | 15 (1.6%) |
| Blood and blood forming organ diseases | 61 (2.0%) | 45 (2.1%) | 16 (1.8%) |
| Bradycardias and conduction diseases | 79 (2.6%) | 64 (2.9%) | 15 (1.6%) |
| Cardiac valve diseases | 152 (4.9%) | 124 (5.7%) | 28 (3.1%) |
| Cataract and other lens diseases | 1012 (32.7%) | 713 (32.6%) | 299 (32.7%) |
| Cerebrovascular disease | 286 (9.2%) | 220 (10.1%) | 66 (7.2%) |
| Chronic infectious diseases | 13 (0.4%) | 11 (0.5%) | 2 (0.2%) |
| Chromosomal abnormalities | 1 (0.0%) | 0 (0%) | 1 (0.1%) |
| Colitis and related diseases | 453 (14.6%) | 328 (15.0%) | 125 (13.7%) |
| COPD, emphysema, chronic bronchitis | 301 (9.7%) | 228 (10.4%) | 73 (8.0%) |
| Deafness, hearing loss | 143 (4.6%) | 103 (4.7%) | 40 (4.4%) |
| Dementia | 165 (5.3%) | 143 (6.5%) | 22 (2.4%) |
| Depression and mood diseases | 201 (6.5%) | 144 (6.6%) | 57 (6.2%) |
| Diabetes | 533 (17.2%) | 391 (17.9%) | 142 (15.6%) |
| Dorsopathies | 286 (9.2%) | 207 (9.5%) | 79 (8.7%) |
| Dyslipidemia | 187 (6.0%) | 152 (7.0%) | 35 (3.8%) |
| Ear, nose, throat diseases | 141 (4.6%) | 95 (4.3%) | 46 (5.0%) |
| Epilepsy | 58 (1.9%) | 40 (1.8%) | 18 (2.0%) |
| Esophagus, stomach and duodenum diseases | 305 (9.8%) | 198 (9.1%) | 107 (11.7%) |
| Glaucoma | 243 (7.8%) | 189 (8.6%) | 54 (5.9%) |
| Heart failure | 393 (12.7%) | 319 (14.6%) | 74 (8.1%) |
| Hematological neoplasms | 57 (1.8%) | 48 (2.2%) | 9 (1.0%) |
| Hypertension | 1443 (46.6%) | 1082 (49.5%) | 361 (39.5%) |
| Inflammatory arthropathies | 151 (4.9%) | 112 (5.1%) | 39 (4.3%) |
| Inflammatory bowel disease | 56 (1.8%) | 39 (1.8%) | 17 (1.9%) |
| Ischemic heart disease | 428 (13.8%) | 325 (14.9%) | 103 (11.3%) |
| Chronic kidney disease | 117 (3.8%) | 99 (4.5%) | 18 (2.0%) |
| Chronic liver disease | 28 (0.9%) | 16 (0.7%) | 12 (1.3%) |
| Migraine and facial pain syndromes | 82 (2.6%) | 53 (2.4%) | 29 (3.2%) |
| Multiple sclerosis | 13 (0.4%) | 9 (0.4%) | 4 (0.4%) |
| Neurotic, stress-related and somatoform diseases | 178 (5.7%) | 127 (5.8%) | 51 (5.6%) |
| Obesity | 74 (2.4%) | 51 (2.3%) | 23 (2.5%) |
| Osteoarthritis and other degenerative joint diseases | 353 (11.4%) | 238 (10.9%) | 115 (12.6%) |
| Osteoporosis | 720 (23.2%) | 501 (22.9%) | 219 (24.0%) |
| Other cardiovascular diseases | 131 (4.2%) | 108 (4.9%) | 23 (2.5%) |
| Other digestive diseases | 32 (1.0%) | 27 (1.2%) | 5 (0.5%) |
| Other eye diseases | 680 (21.9%) | 492 (22.5%) | 188 (20.6%) |
| Other genitourinary diseases | 393 (12.7%) | 275 (12.6%) | 118 (12.9%) |
| Other metabolic diseases | 225 (7.3%) | 154 (7.0%) | 71 (7.8%) |
| Other musculoskeletal and joint diseases | 366 (11.8%) | 235 (10.8%) | 131 (14.3%) |
| Other neurological diseases | 141 (4.6%) | 107 (4.9%) | 34 (3.7%) |
| Other psychiatric and behavioral diseases | 112 (3.6%) | 77 (3.5%) | 35 (3.8%) |
| Other respiratory diseases | 55 (1.8%) | 44 (2.0%) | 11 (1.2%) |
| Other skin diseases | 44 (1.4%) | 33 (1.5%) | 11 (1.2%) |
| Chronic pancreas, biliary tract and gallbladder diseases | 112 (3.6%) | 76 (3.5%) | 36 (3.9%) |
| Parkinson and parkinsonism | 57 (1.8%) | 46 (2.1%) | 11 (1.2%) |
| Peripheral neuropathy | 143 (4.6%) | 102 (4.7%) | 41 (4.5%) |
| Peripheral vascular disease | 54 (1.7%) | 40 (1.8%) | 14 (1.5%) |
| Prostate diseases | 13 (0.4%) | 11 (0.5%) | 2 (0.2%) |
| Schizophrenia and delusional diseases | 26 (0.8%) | 22 (1.0%) | 4 (0.4%) |
| Sleep disorders | 52 (1.7%) | 35 (1.6%) | 17 (1.9%) |
| Solid neoplasms | 1890 (61.0%) | 1318 (60.3%) | 572 (62.7%) |
| Thyroid disease | 612 (19.8%) | 430 (19.7%) | 182 (19.9%) |
| Chronic ulcer of the skin | 149 (4.8%) | 108 (4.9%) | 41 (4.5%) |
| Venous and lymphatic diseases | 185 (6.0%) | 138 (6.3%) | 47 (5.1%) |
|  |  |  |  |

\*Identified from the National Patient Register and Prescribed Drug register

## eTable 8: Sensitivity analysis of endocrine treatment patterns at the end of life in Sweden, 2016-2020

|  |  |  |
| --- | --- | --- |
| **Population** | **Overall** | **Endocrine treatment patterns at the end of life** |
| **Continuation** | **Discontinuation** | **Initiation** | **No use** |
| **Study population** | 3098 | 1217 (39.3%) | 968 (31.2%) | 157 (5.1%) | 756 (24.4%) |
| **Age 75 or older** | 1922 | 902 (46.9%) | 332 (17.3%) | 74 (3.9%) | 614 (31.9%) |
| **Breast cancer population (HR+)** | 4071 | 1911 (46.9%) | 1129 (27.7%) | 182 (4.5%) | 849 (20.9%) |
| **Breast cancer (ICD10-code: C50) as underlying cause of death** | 2752 | 1029 (37.4%) | 474 (17.2%) | 148 (5.4%) | 1101 (40.0%) |
|  |  |  |  |  |  |

Abbreviations: HR+ = Hormone receptor-positive breast cancer

## References

1. Ludvigsson JF, Almqvist C, Bonamy AK, et al. Registers of the Swedish total population and their use in medical research. Eur J Epidemiol 2016;31:125-36.

2. Brooke HL, Talbäck M, Hörnblad J, et al. The Swedish cause of death register. Eur J Epidemiol 2017;32:765-773.

3. Ludvigsson JF, Andersson E, Ekbom A, et al. External review and validation of the Swedish national inpatient register. BMC Public Health 2011;11:450.

4. Wallerstedt SM, Wettermark B, Hoffmann M. The First Decade with the Swedish Prescribed Drug Register - A Systematic Review of the Output in the Scientific Literature. Basic Clin Pharmacol Toxicol 2016;119:464-469.

5. Wettermark B, Hammar N, Fored CM, et al. The new Swedish Prescribed Drug Register--opportunities for pharmacoepidemiological research and experience from the first six months. Pharmacoepidemiol Drug Saf 2007;16:726-35.

6. Halldén K. The Swedish educational system and classifying education using the ISCED‐97, The international standard classification of education (ISCED97). An evaluation of content and criterion validity for 15 European countries. ed. Mannheim: University of Mannheim, 2008.

7. Morin L, Todd A, Barclay S, et al. Preventive drugs in the last year of life of older adults with cancer: Is there room for deprescribing? Cancer 2019;125:2309-2317.

8. Morin L, Wastesson JW, Laroche ML, Fastbom J, Johnell K. How many older adults receive drugs of questionable clinical benefit near the end of life? A cohort study. Palliat Med 2019;33:1080-1090.

9. Benchimol EI, Smeeth L, Guttmann A, et al. The REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) statement. PLoS Med 2015;12:e1001885.